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INFRARED SOLAR SPECTRUM IN THE 1.1μ REGION OBSERVED FROM A BALLOON BORNE SPECTROMETER

Aharon Goldman, David Murcray

Frank Murcray, and Walter Williams

Department of Physics
University of Denver
Denver, Colorado 80210

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Work Unit No. 86620101

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Contract Monitor: Charles V. Cunniff
Optical Physics Laboratory

Prepared for

Air Force Cambridge Research Laboratories
Office of Aerospace Research
United States Air Force
Bedford, Massachusetts

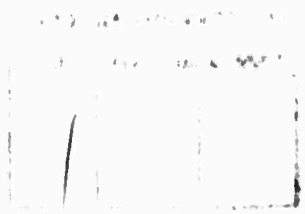

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TABLE OF CONTENTS

LIST OF FIGURES

ABSTRACT

Records are presented of the infrared solar spectrum in the 1.1μ region, observed from altitudes up to 30 km, with a resolution of 0.50Å. The spectra show many new solar absorption lines which appear only at high altitudes where the telluric absorptions are eliminated.

1. INTRODUCTION

In this report are presented preliminary results obtained during the balloon flight performed Aug. 7, 1967. The flight details are described in a recent report.[1] During this flight high altitude atmospheric transmission data, with the sun as a source, was obtained. The spectral region scanned was from 1 to 2μ, with a resolution of ~0.5Å.

Although the determination of strictly solar absorption lines was not of primary interest in this flight, it was realized that the data is rich with new atomic solar lines. Many of these lines are obscured by telluric absorptions when observed from the ground. A short note presenting few of these lines was accepted for publication in the Astrophysical Journal.[2]

In the first phase of the work wavelength determinations and identifications are presented for the 1.1μ region. The 1.1μ region was arbitrarily chosen to start at the 10827.1 SiI line and to end at the 11991.6 SiI. Most of this region is greatly masked by the 1.1μ H_2O band in ground observations. The solar lines could be recognized by observing the spectrum as a function of altitude. The amount of telluric lines is gradually reduced while the solar features remain the same. The repetition of these features in several scans confirms their reality. From the point of view of atmospheric transmission it is seen from the present spectra that the atmospheric absorption in the 1.1μ region is no longer measurable above 50,000 ft.

2. RESULTS

The results are shown in Fig. 1, which is in the form of an atlas. The 1.1μ region is divided into 6 sections with a small overlap at the ends of each section. The last section contains few lines with wavelength longer than mentioned in the introduction.

The Atlas shows up to 5 of the best scans of the same sections. The corresponding altitude and scan times are shown in Table 1. The zero line level is shown by the base line which is the zero line for Rec. 7. All other records are displayed vertically by 20% of the total deflection. A wavelength scale is constructed on each page. However this scale is to be used as a guide only since slight fluctuations in the recording speed result in shifts in the scale. The confirmed solar absorption lines are marked with a vertical dash and the wavelength (in air) of each is written above the line in Rec. 14.

In addition to a temporary complete lost signal, some scans show occasionally oscillation in amplitude, as in Rec. 10 near 11950Å. This structure is not real and was recently eliminated by redigitizing the flight tape, without affecting the spectral real structure.

The measured wavelengths were established within 0.3Å, using for calibration atmospheric lines and already known solar lines. The atomic solar lines have been identified using the methods described in Ref. 2. A line in the atlas which is marked with a wavelength but has not identification means a confirmed solar feature, yet to be spectroscopically identified. The identification of those lines, and the analysis of the complete region 1-2μ are in progress.

ACKNOWLEDGMENTS

A portion of the computer time required was made available by the National Center for Atmospheric Research, Boulder, Colorado.

Our thanks to Charles Garwood, Steve Smith, and John Van Allen for valuable assistance on the data reduction.

The launch and recovery of the balloon instrumentation was capably handled by the Air Force Cambridge Research Laboratory Balloon Group.

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1. D. G. Murcray, "Atmospheric Transmittance Studies," AFCRL-68-0278 Final Report, Contract AF 19(628)-5202, 31 March 1968, University of Denver, Colorado, 80210.

2. A. Goldman, D. G. Murcray, F. H. Murcray and W. J. Williams, "Atomic Solar Lines in the Region 1-2 Micron Observed from a Balloon-Borne Spectrometer," Astrophys. J. (in press, 1968).

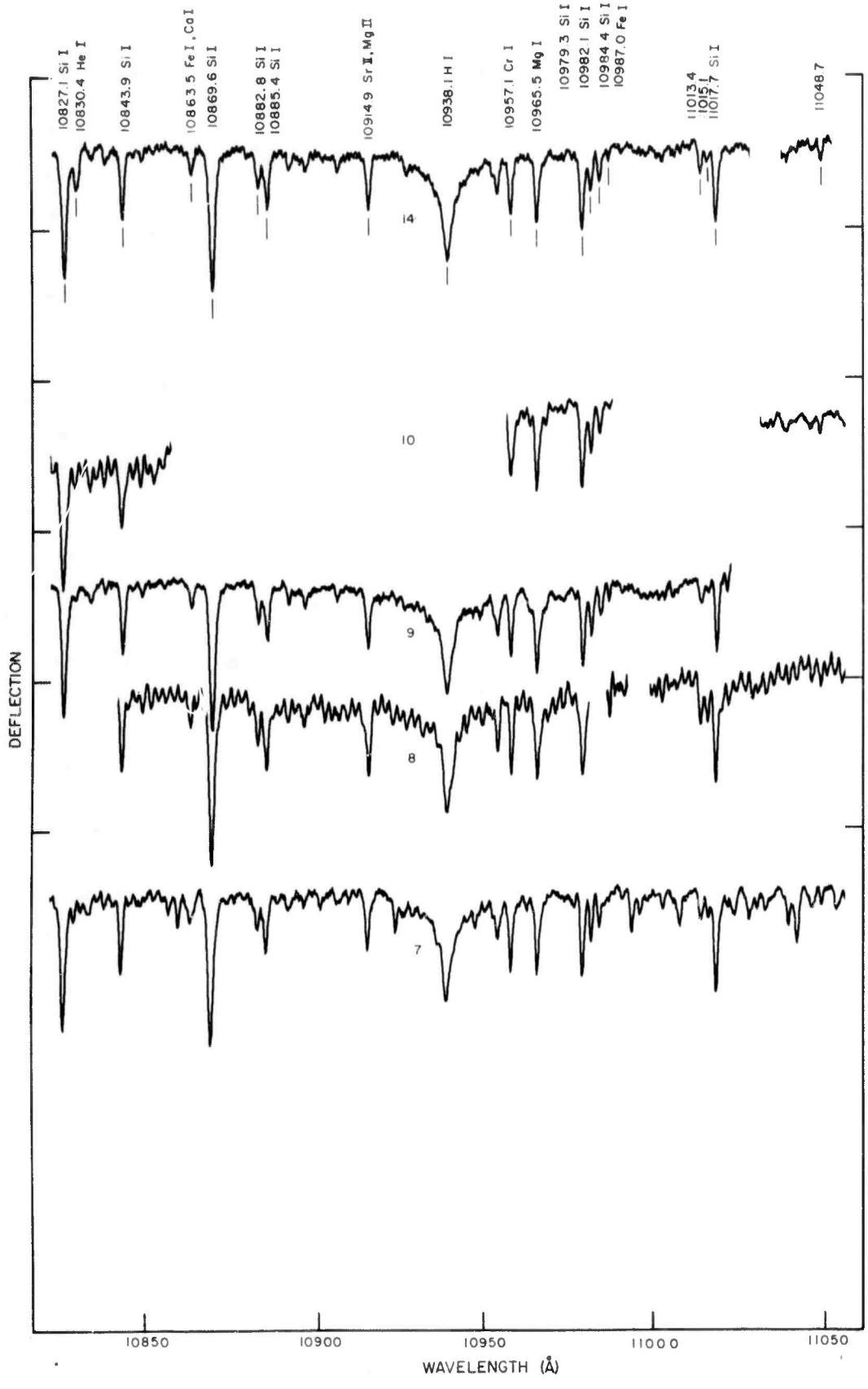
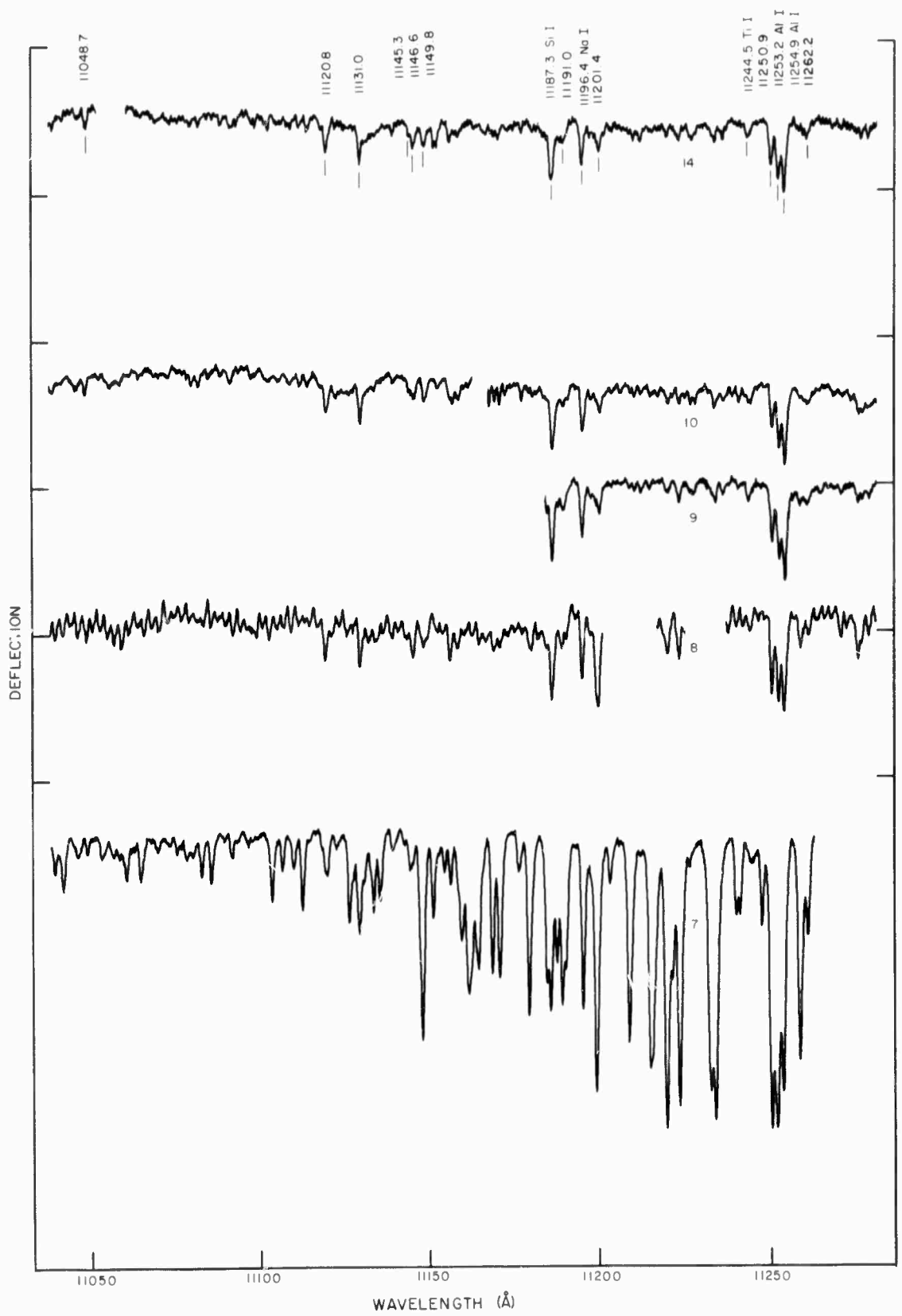


Figure No. 1. Variations with Altitude of the Solar Spectrum in the 1.1μ Region.



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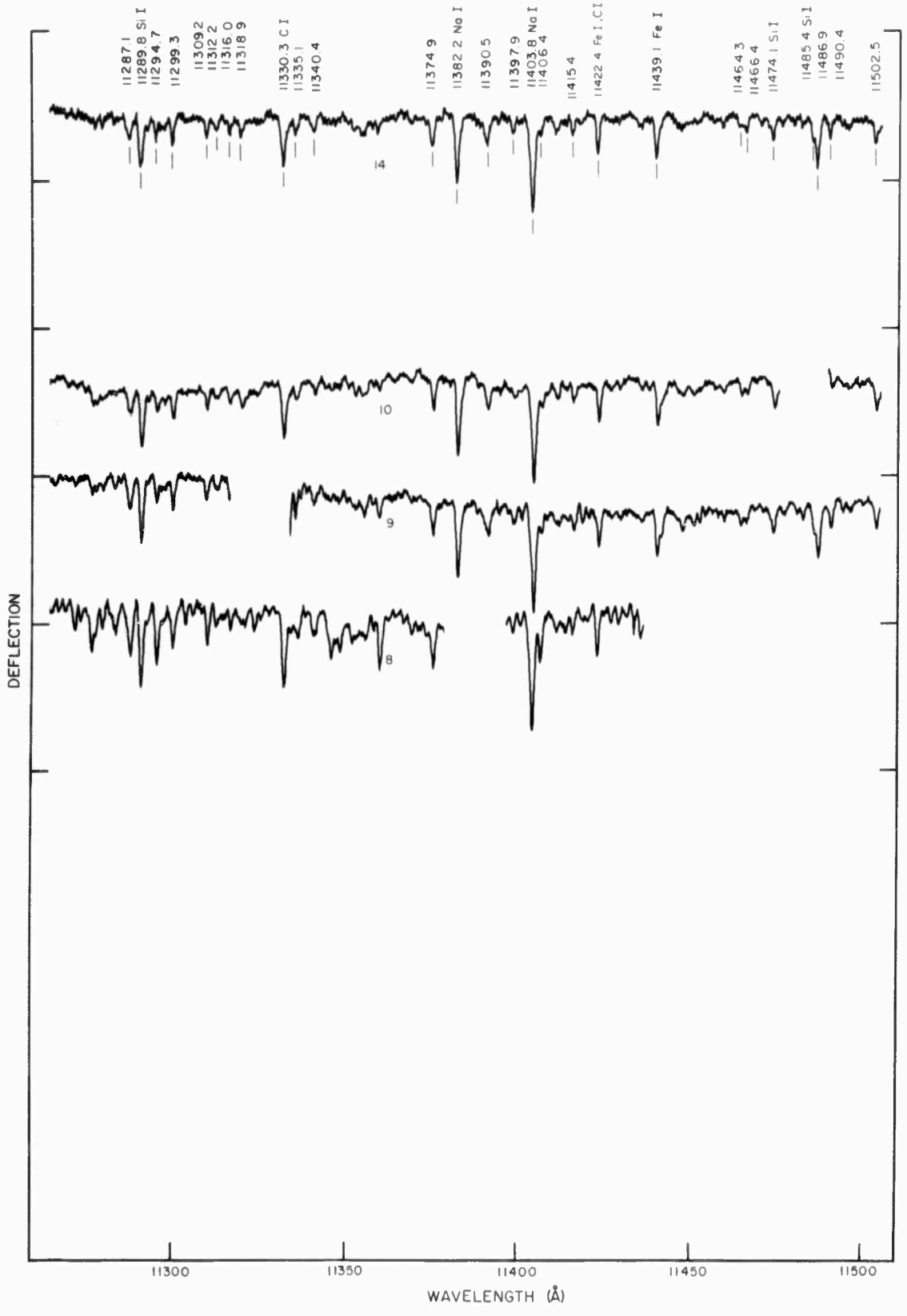

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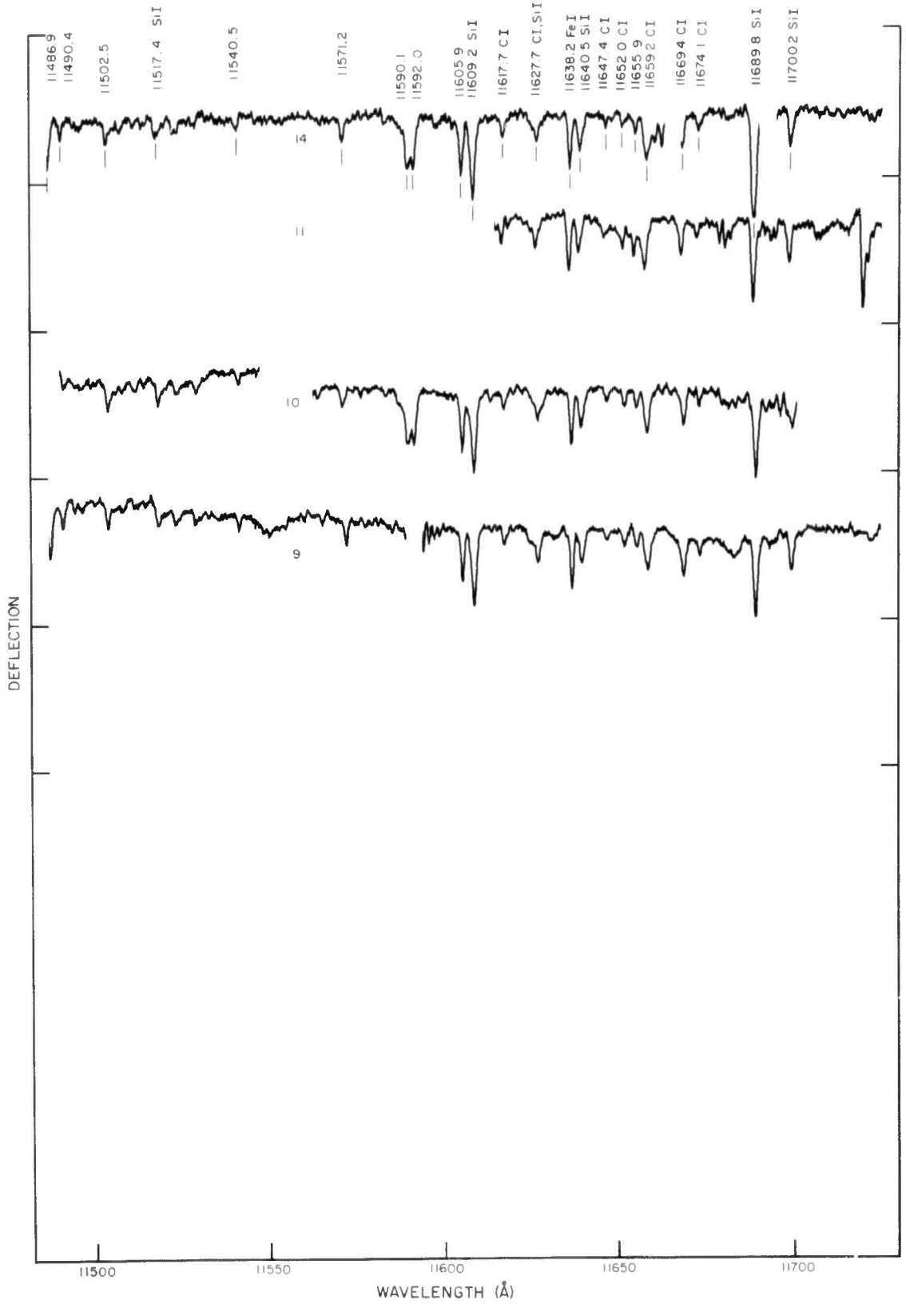

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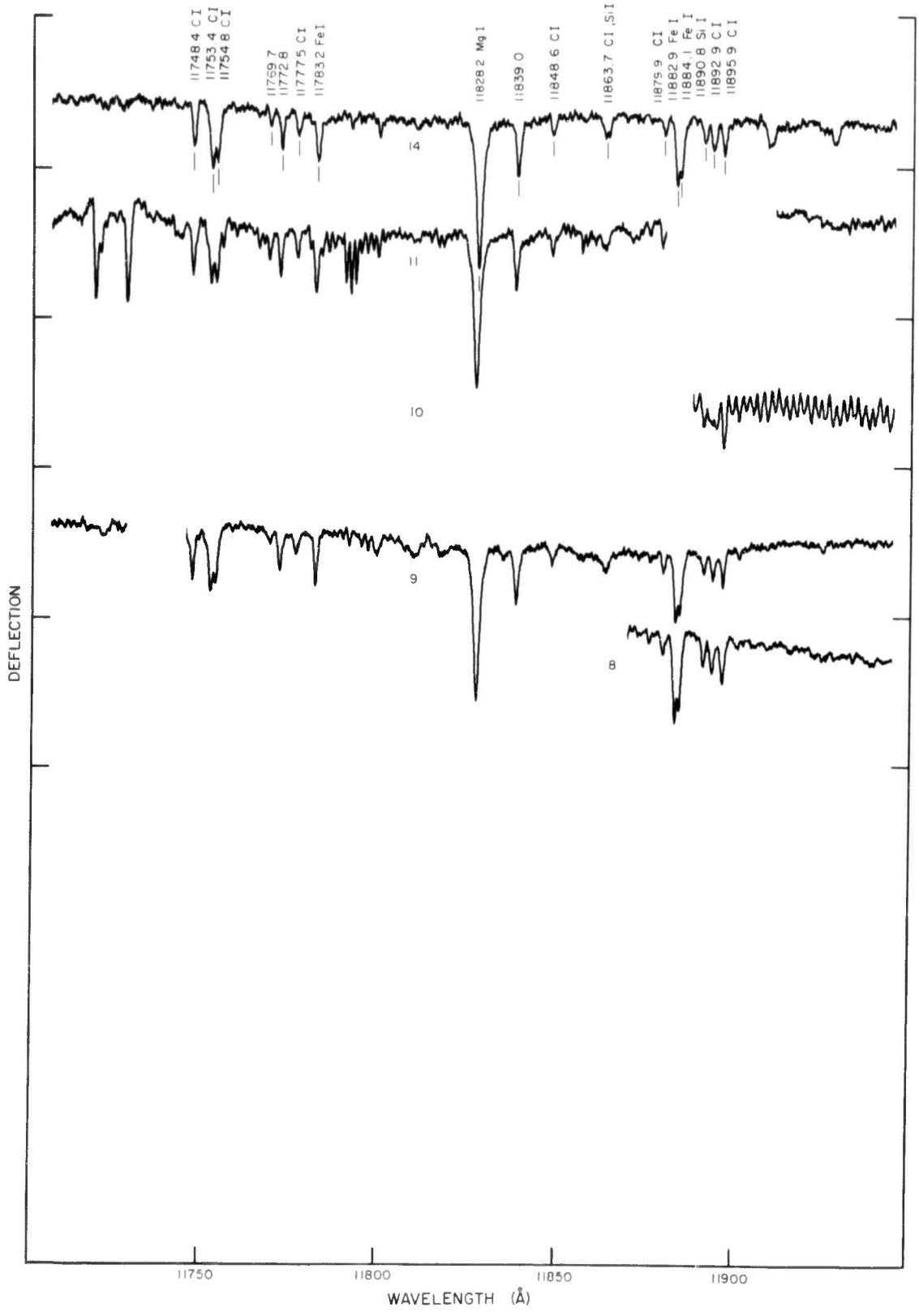

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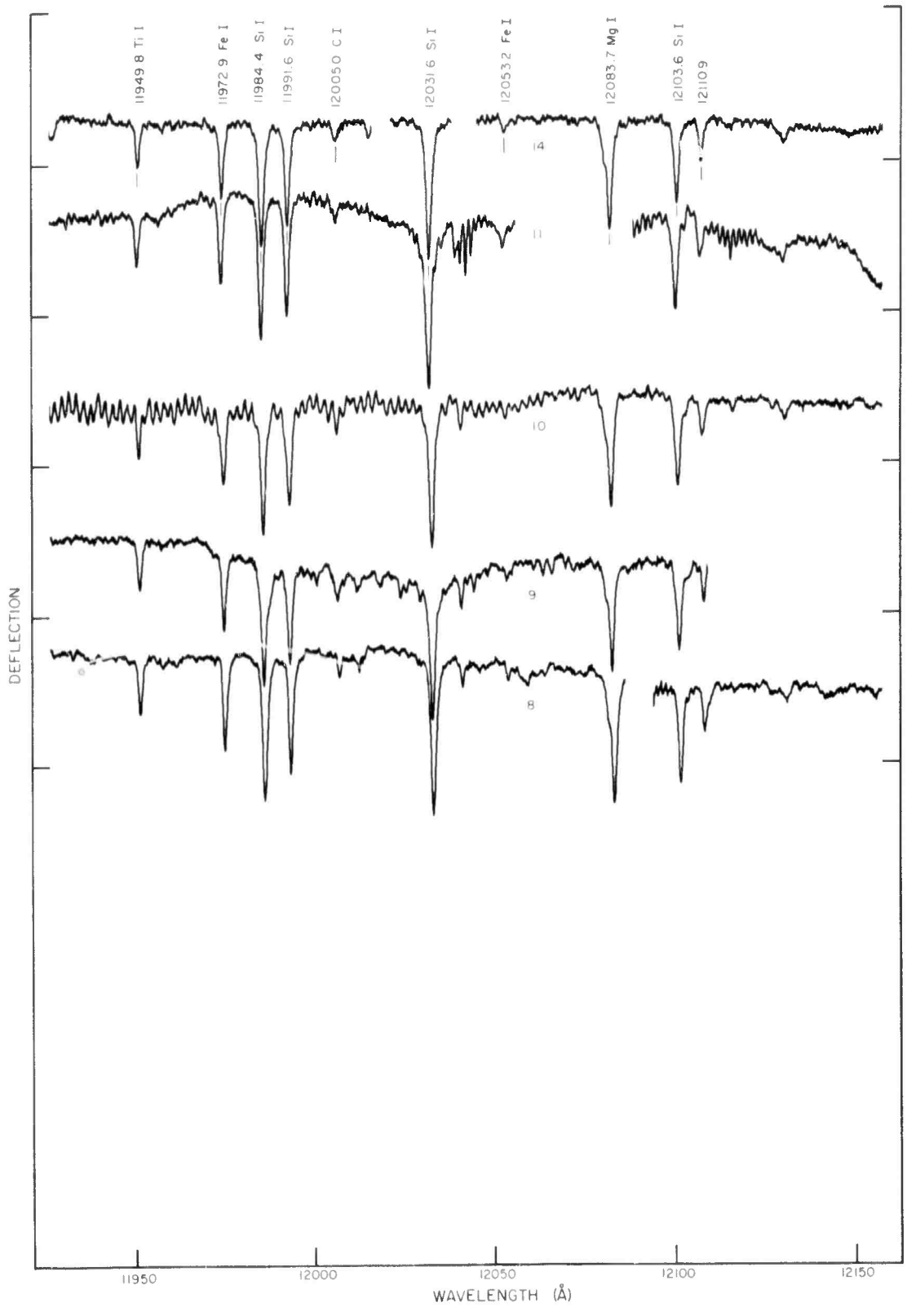

Figure No. 1. Cont'd.

TABLE I

Times and Altitudes for the Selected Records Shown in Fig. 1

Record No.	Time (MST)	Altitude kf
7	7:28 - 7:46	24.5 - 36.5
8	7:46 - 8:04	36.5 - 52.0
9	8:04 - 8:22	52.0 - 62.0
10	8:22 - 8:40	62.0 - 75.3
14	9:34 - 9:52	96.3 - 96.3

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